

NISTTech

Rotary Cam-Driven Free Fall Dropping Chamber Mechanism

Accurately determine local gravity conditions by frequently measuring the local acceleration using a small, portable gravimeter

Description

Improved gravimeter apparatus that creates and frequently measures the free fall of a dropped object while eliminating or reducing any deleterious effects such as disturbances caused by weight displacement, rotation of the dropping object, etc. The mechanism involves a cam attached to a camshaft which turns at a constant selected rate. The measuring mass contains a mirror element of a Michelson interferometer, and the interferometer produces a signal indicative of the rate of free fall, which is directly proportional to the local gravity.

In order to reduce the overall size and weight of the gravimeter, the cam has a diameter of approximately 15 cm, which is dictated by the length of free fall and allowable (about 2.5 g) deceleration together with a return to start motion which purposely never exceeds 1 g, where g is the known local acceleration due to gravity. With this cam size, the length of free fall is about 2 cm. The rotation rate of about 0.3 seconds per rotation allows for three measurements per second which is relatively fast compared to conventional gravimeters.

Applications

- **Geologic exploration**
Helps to determine underlying geologic structures by accurately measuring the local acceleration due to gravity.

Advantages

- **Repeatable and rapid measurements**
Provides up to three measurements per second, and substantially increases the rate of data collection.
- **Portable**
Lightweight and easy to transport.

Abstract

An improved gravimeter mechanism includes a mass balanced cam having mutually opposed camming surfaces for controlling the free fall of a measuring mass. The cam is attached to a camshaft which turns at a constant rate, the rate being

selected so that the drop time appropriate to achieve lift-off of the dropped object together with the time required to return to the start position equals the cam's rotational period. The mutually opposed camming surfaces cooperate to drive both a cart which supports a measuring mass and a compensating mass which is built into the gravimeter mechanism. The cam drives the cart, the measuring mass, and the compensating mass so that the time varying reduction in weight produced when the measuring mass is in free fall is exactly compensated by the compensating mass which is driven by the opposing camming surface. The opposing camming surface is displaced from the lift off region of the camming surface which drives the cart and measuring mass by 180 degrees. The measuring mass contains a mirror element of a Michelson interferometer, and the interferometer produces a signal indicative of the rate of free fall, which is directly proportional to the local gravity.

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References

- U.S. expired Patent # 6,298,722
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Status of Availability

This technology is available in the public domain.

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